tients had sustained VT, 7 had nonsustained VT, 3 had polymorphic VT, and 2 had VF.

At a mean follow up of 23 (± 13) months, 12 patients have had a total of 30 appropriate ICD firings (defined as shock with preceding symptoms (n = 6 pts) or shock with intracardiac recordings consistent with ventricular arrhythmia (n = 6 pts)). EF < 30%, age, and CAD were not predictors of arrhythmia recurrence.

There is a substantial incidence of recurrent arrhythmias in this population, supporting the current clinical practice of ICD implantation for this indication. Further studies should examine a larger population and examine predictors of arrhythmia recurrence.

9:30

739-5 Prospective Evaluation of the Defibrillation Success With Two Superior Vena Cava Electrodes: Comparison of Two Lead Positions

Andrea Natale, Margaret M. Kearney, M. Joan Brandon, Virginia Kent, Keith H. Newby. *VA Medical Center/Duke University, Durham, NC*

When the superior vena cava (SCV), right ventricular coil (RV) system does not provide adequate ventricular defibrillation, an additional SVC lead could be used to improve defibrillation efficacy. However, no data exists on the efficacy of this system and on the ideal position of the second SVC coil. In 17 patients undergoing defibrillator implant, we prospectively examined the defibrillation efficacy of the SVC/RV configuration as compared to a 2 SVC/RV configuration with the second SVC placed either "side by side" (SBS) with the first one, or with proximal end of the second SVC coil adjacent to the tip of the first SVC coil "head to tail". In the SVC/RV configuration, the SVC coil was in the innominate vein. The second SVC was in the same location in the "side by side" configuration and was advanced in the SVC in the "head to tail"(HTT) configuration. In each patient, all 3 configurations were tested randomly with biphasic shocks.

	SVC/RV	2SVC/SBS	2SVC/HTT
Energy	14.4 ± 7.9	12.4 ± 6.7	11.1 ± 7.1*
Voltage	485 ± 138	445 ± 118	415 ± 136*

*p < 0.0002

Conclusion: 1) the addition of a second SVC coil provides improved defibrillation efficacy. 2) However, the "head to tail" configuration appeared to require lower energy for defibrillation and should be preferred.

9:45

739-6 *In Situ* Optical and Bipolar Electrogram Recordings in Swine Show Parallel Reductions in Action Potential and Electrogram Amplitude Following High-Voltage Shocks

Volker Menz, John J. Michele, Stephen M. Dillon. *Philadelphia Heart Institute, Philadelphia, PA; Univ of Marburg, Marburg, Germany*

We and others have found shock strength-dependent reduction and time-dependent recovery of electrogram amplitude (EA) recorded by endocardial defibrillation lead systems following high voltage shocks. *In vitro* studies by others have shown related shock strength- and time-dependent changes in the action potential amplitude (APA). The purpose of the present study was to determine whether the reduction of EA we found *in vivo* could be correlated with a reduction of the APA. We recorded an optical signal and a bipolar electrogram at sites on the anterior left ventricular epicardium of swine (28 ± 12 kg, n = 8) during the application of epicardial shocks. Optical recordings of membrane responses were taken using a 1.5 mm fiber optic pickup after injection of a voltage-sensitive dye (di-4-ANEPPS, 21 μM in Ringers) into the LAD by coronary catheterization. Bipolar electrograms and shock voltage gradients (VGs) were recorded through 3 non-polarizable Ag/AgCl electrodes surrounding the fiberoptic pickup. Shocks were delivered through a pair of stainless steel mesh electrodes 50 mm long, 5 mm wide having a 40 mm edge separation. The recording site was halfway between the shock electrodes. Monophasic shocks (5 ms width, 100 to 990 V) were delivered during the diastole of sinus rhythm 400 ms after the sensed depolarization. *Result:* The EAs and APAs showed parallel reductions with increasing shock strength and parallel recoveries with increasing time after the shock. Significant reductions in both the APA and EA were observed at VG > 70 V/cm (p < 0.03). *Conclusion:* Our results suggest that the decrease of EA recorded by endocardial defibrillation leads may be caused by transient membrane damage rather than instrumental factors and that this effect may be related to that observed using microelectrode recordings *in vitro*.

740 Three-Dimensional Echocardiography: New Instrumentation and Clinical Applications

Tuesday, March 26, 1996, 8:30 a.m.–10:00 a.m.
Orange County Convention Center, Room 315

8:30

740-1 Accurate Quantitation of Right Ventricular Size and Function by Voxel-Based 3-Dimensional Echocardiography in Patients With Normal and Abnormal Ventricles (3DE): Comparison With Magnetic Resonance Imaging

H.J. Nesser, W. Tkalec, J. Niel, Navroz Masani, Natesa Pandian. *General Hospital St Elizabeth, Linz, Austria; Tufts-New England Medical Center, Boston, Massachusetts*

We have shown *in vitro* that voxel-based 3-dimensional echocardiography (3DE) could quantify RV volume (V). Work by others have dealt with in vivo dog studies, clinical study of normals or studies limited to quantitation without 3D display. How well voxel-based, tissue-depiction 3DE can quantify RV V and function (%EF) in pts with abnormal RVs by transesophageal (TEE) and transthoracic (TTE) approaches are not known. To assess this, we studied 20 pts (age 23 to 76 yrs) including those with abnormal RV. 3DE data were compared to data from MRI. 3DE studies were performed from TTE windows by rotational scanning *and* from TEE window with a multiplane probe. *Results:* Dynamic 3DE images of the RV, displayed in a variety of projections both by TEE-3DE and by TTE-3DE, facilitated qualitative assessment of RV size, geometry, morphology and motion. Quantitative data were (mean ± sd): MRI (x) vs. TEE-3DE (y): *EDV in ml:* 109 ± 34 [range 60–191] vs 108 ± 30; *Correlation:* y = 0.7x + 27, r = 0.86, [p < 0.0001, *mean diff:* 1.3 ml. *ESV:* 59 ± 31 [range 20–130] vs 62 ± 31; *Correlation:* y = 0.9x + 8, r = 0.92, p < 0.0001, mean diff 2.7 ml. *%EF:* 48 ± 17 [range 16–75] vs 43 ± 12; *Correlation:* y = 0.58x + 15, r = 0.84, p < 0.0001, *mean diff* 4.5 ± 10%. *Similar values and excellent correlations (vs MRI) were obtained by TTE: %EF:* y = 0.57x + 18, r = 0.85, p < 0.0001, *mean diff* 2.5 ± 9%. We conclude that, in addition to dynamic displays of the RV interior, voxel-based 3DE provides accurate quantitation of both normal and abnormal RV volume and function.

8:45

740-2 Voxel Reconstruction of Mitral Valves and Left Ventricles From Limited Sets of Rotationally Scanned Transesophageal Images

Xiang-Ning Li, Roy W. Martin, Malcolm Legget, Brad Munt, Murali Sivarajan, Gerard Bashein, Daniel F. Leotta, Florence H. Sheehan, Edward Bolson, Catherine M. Otto. *University of Washington, Seattle, WA*

Voxel reconstruction usually requires high image density, e.g., ninety rotationally scans at two degree angular increments. Acquisition of such dense data requires seven to ten minutes with respiratory gating. We analyzed the feasibility of volumetric reconstruction from a less dense data set so that image acquisition can be completed within a single mechanical ventilation pause. *Method:* Eighteen patients (10 normal and 8 with heart disease) were scanned under general anesthesia with a 5 MHz Hewlett Packard multiplane transesophageal echocardiographic (TEE) probe. Images from 28–40 planes at 5–10 degree angular increments, with 24 to 35 consecutive video frames per cardiac cycle, were digitized. We applied linear interpolation along the polar space to fill the void volumetric space. Reconstruction of the mitral valves and left ventricle was accomplished for every 33 ms of a cardiac cycle. *Results:* All anatomical landmarks of the left ventricle were clearly identifiable from volume rendered images. With animation from selected views cardiac function could be assessed. Stereographic visualization added further clarity. *Conclusion:* With linear interpolation in polar space voxel reconstruction can be performed from lower density 3D TEE scans. This approach may increase accuracy in 3D imaging by permitting the image acquisition during a single ventilation pause.

9:00

740-3 Real-Time, Three-Dimensional Echo: System Improvements, Scanning Methods and Normal Cardiac Anatomy

Craig E. Fleishman, Takahiro Ota, Jennifer Li, A. Resai Bengur, Olaf von Ramm, Joseph Kisslo. *Duke University, Durham, NC*

On the hypothesis that gross normal cardiac anatomic structures could be defined using real-time, three-dimensional echo (RT3D), studies were performed on 33 subjects (ages 1–48 years). Images were obtained using a

TUESDAY ORAL